PATENT COOPERATION TREATY
Supplement to Amendment Under Article 34 dated August 26, 2005

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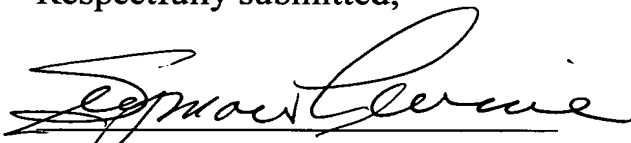Title: <u>Atmospheric Turbulence Hazard Detector</u>

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An amendment under Article 34 was forwarded to the PCT office on August 26, 2005. Claim 14 was inadvertently omitted from the attachment to the amendment containing the claims now in the above referenced application.

Kindly replace pages 33-39 in the attachment of August 26, 2005 with the attached pages 33-40.

Respectfully submitted,

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1   13.   A method for detecting atmospheric disturbances in accordance with
2   claim 12 wherein said filtering step and said detecting step are performed in
3   sound sensors subsequent to said at least one sound sensor, said filtering step
4   being activated by said extracted noise obtained from noise spectra received at
5   said least one sound sensor.

1   14.   A method for detecting atmospheric disturbances including the steps of:
2   sensing atmospheric noise to obtain noise signals;
3   filtering said noise signals to eliminate signals at frequencies above a
4   predetermined frequency and providing signals at frequencies within a band of
5   frequencies below said predetermined frequency;
6   comparing amplitudes of signals at frequencies in said band below said
7   predetermined frequency to a first preselected threshold;
8   determining a representative amplitude and representative frequency for
9   signals at frequencies in said band below said predetermined frequency that
10   have amplitudes which exceed said first preselected threshold;
11   comparing said representative frequency to a predetermined frequency
12   threshold;
13   comparing said representative amplitude to a second preselected threshold
14   when said representative frequency exceeds said predetermined frequency
15   threshold ; and
16   indicating when said representative amplitude exceeds said second
17   preselected threshold.

1   15.   The method of claim 14 wherein said filtering step includes the step of

2   placing signals having frequencies within said band of frequencies in frequency

3   bins and determining amplitudes and phases of signals in each bin.

1   16.   The method of claim 15 wherein said amplitude comparing step includes

2   the step of comparing said amplitudes of signals in each of said frequency bins

3   to said first preselected threshold.

1   17.   The method of claim 14 wherein:

2   said sensing step includes the step of

3   providing first and second sensors to obtain first and second noise signals,

4   respectively;

5   said filtering step includes the steps of

6   establishing a first band of signals having frequencies below said

7   predetermined frequency in said first noise signal and a second band of signals

8   having frequencies below said predetermined frequency in said second noise

9   signal; and

10   utilizing said first and second bands of signals to estimate an angle off a

11   reference of said atmospheric disturbance and to estimate a range to said

12   atmospheric disturbance.

1   18.   The method of claim 17 wherein said utilizing step includes the steps of:

2   computing electrical phase differences between signals in said first band

3   and signals in said second band; and

4   converting said electrical phase differences to said angle off said

5   reference.

1 19. The method of claim 18 wherein said computing step computes phase
2 differences between signals in said first band and signals in said second having
3 equal frequencies.

1 20. The method of claim 17 wherein said establishing step includes the steps
2 of:
3   placing signals having frequencies within said first band into first
4 frequency bins and determining phases and amplitudes of signals in each of said
5 first frequency bins;
6   placing signals having frequencies within said second band into second
7 frequency bins and determining phases and amplitudes of signals in each of said
8 second frequency bins.

1 21. The method of claim 20 further including the steps of:
2   determining phases differences between signals in bins of said first band
3 and signals in corresponding bins of said second band, a bin in said first band
4 and a corresponding bin in said second band comprising a bin set, thereby
5 obtaining a bin set phase difference for each of said bin sets; and
6   utilizing said bin set phase differences to estimate an angle of said
7 atmospheric disturbance from a reference direction.

1   22.   The method of claim 21 wherein said utilizing step includes the steps of:

2   averaging signal amplitudes in bins of said first band with signal

3 amplitudes in corresponding bins of said second band, to obtain a bin set

4 average amplitude for each set of corresponding bins;

5   multiplying bin set average amplitudes by said bin set phase differences,

6 respectively, to obtain set products of bin phase multiplied by bin average

7 amplitude;

8   summing said set products over all bin sets, to obtain a sum of set

9 products;

10   summing said set average amplitudes over all bin sets to obtain a sum of

11 set average amplitudes; and

12   dividing said sum of set products by said sum of average amplitudes to

13 obtain said estimate of said angle.

1   23.   The method of claim 20 wherein said comparing amplitudes step includes

2 the step of

3   comparing amplitudes of signals in said first band and amplitudes of

4 signals in said second band to said first preselected threshold and removing

5 signals from bins, in said first and second bands, with amplitudes that do not

6 exceed said first preselected threshold; and further including the steps of:

7   combining amplitudes of signals in said first and second bands that

8 exceed said first preselected threshold at a first location, to obtain a first

9 combined amplitude signal and combining amplitudes of signals in said first and

10 second bands that exceed said first preselected threshold at a second location, to

11 obtain a second combined amplitude signal;   using said first and second

12 combined amplitude signals to estimate range to said atmospheric disturbance.

1   24.   The method of claim 23 wherein said combining includes the steps of:

2   computing rms sum of signal amplitudes at said first location in said first

3   and second frequency bins to obtain rms sum signals A_1 and B_1, respectively;

4   and

5   computing rms sum of signal amplitudes at said second location in said

6   first and second frequency bins to obtain rms sum signals A_2 and B_2,

7   respectively.

1   25.   The method of claim 24 wherein said using step includes the steps of:

2   averaging A_1 and B_1 to obtain an average signal S_1, and averaging A_2 and

3   B_2 to obtain an average signal S_2;

4   forming a ratio $r = S_1/S_2$;

5   noting a difference in position of said first location and said second

6   location, said difference in position being $X\cos\theta$, where X is a distance from

7   said first location to said second location and θ is said angle off said reference;

8   and

9   estimating range R to said atmospheric disturbance from $R = X\cos\theta/(r - 1)$.

1   26.   A method for detecting atmospheric disturbances in accordance with claim 1

2   wherein said providing step includes the steps of;

3   extracting noise at frequencies below a specified frequency from said

4   received noise spectra to provide an extracted noise spectra;

5   filtering said extracted noise spectra through a low pass filter to obtain

6   infrasound at frequencies below a predetermined infrasound frequency; and

7   comparing magnitudes of said infrasound at frequencies below said

8   predetermined infrasound frequency to a preselected magnitude.

1   27.   A method for detecting atmospheric disturbances in accordance with claim 26

2   wherein said preselected magnitude is that of a preselected wind velocity.

1   28.   A method for detecting atmospheric disturbances in accordance with claim 26

2   further including the steps of:

3   selecting a signal in said extracted noise spectra, thereby providing a selcted

4   signal;

5   comparing said selected signal to a second predetermined threshold; and

6   deactivating said low pass filter when said signal exceeds said second

7   predetermined threshold.

1   29.   A method for detecting atmospheric disturbances in accordance with claim 26

2   wherein said providing step further includes the step of positioning sound sensors in

3   a plurality of parallel rows positioned perpendicular to and centered on a foot print

4   of an aircraft arrival glide slope.

1   30.   A method for detecting atmospheric disturbances in accordance with claim 29

2   wherein each row contains at least 3 sensors.

1   31.   A method for detecting atmospheric disturbances in accordance with claim 1

2   wherein said providing step includes the steps:

3   obtaining infrasound below a predetermined infrasound frequency, thereby

4   providing extracted infrasound; and

5   detecting magnitudes of said extracted infrasound.

1   32.   A method for detecting atmospheric disturbances in accordance with claim 31

2   wherein said obtaining step includes the steps of:

3   extracting noise at frequencies below a specified frequency from said received

4   noise spectra to provide an extracted noise spectra; and

5   filtering said extracted noise spectra to obtain said extracted infrasound.

1   33.   A method for detecting atmospheric disturbances in accordance with claim 31

2   wherein said providing step includes the step of positioning a noise sensor and said

3   determining step includes the steps of:

4   delaying extracted infrasound for a predetermined time interval, thereby

5   providing delayed extracted infrasound;

6   predicting a time of arrival at said noise sensor of an atmospheric disturbance

7   causing a presently extracted infrasound with the utilization of said delayed

8   extracted infrasound and said presently extracted infrasound.

1   34.   A method for detecting atmospheric disturbances in accordance with claim 33

2   wherein said predicting step includes the steps of:

3   determining magnitudes of said delayed extracted infrasound and said

4   presently extracted infrasound;

5   establishing a ratio of said magnitudes;

6   providing a square root of said ratio; and

7   utilizing said square root, said time delay, and velocity of said infrasound to

8   predict said time of arrival.

1   35.   A method for detecting atmospheric disturbances in accordance with claim 33

2   further including the steps of:

3   producing a signal when magnitudes of said extracted infrasound exceed said

4   infrasound threshold for a predetermined time interval;

5   coupling said signal to a gate to which said time of arrival is also coupled;

6   and

7   supplying said time of arrival through said gate when said signal is received.

1   36.   A method for detecting atmospheric disturbances in accordance with claim 32

2   wherein said filtering step provides infrasound signals at frequencies below a

3   preselected infrasound frequency and said determining step includes the steps of:

4   finding a bandwidth of said infrasound signals having amplitudes greater than

5   a preselected amplitude;

6   calculating a mean frequency and rms amplitude for signals within said

7   bandwidth;

8   comparing said bandwidth, said mean frequency, and said rms amplitude to

9   respective predetermined thresholds; and

10   providing an alarm when said respective thresholds are simultaneously

11   exceeded over a specified time interval.